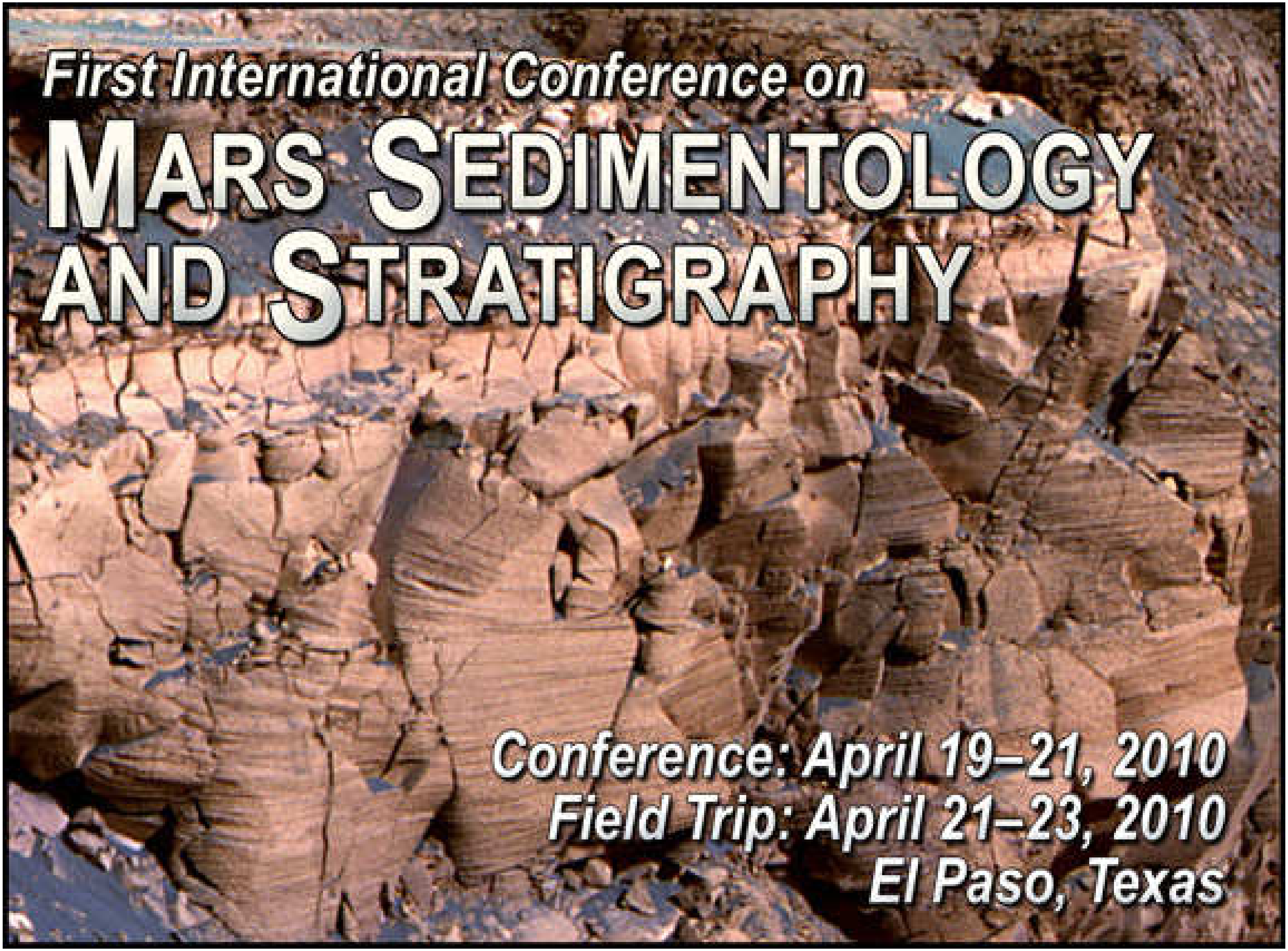
Report on

First International Conference on Mars Sedimentology and Stratigraphy

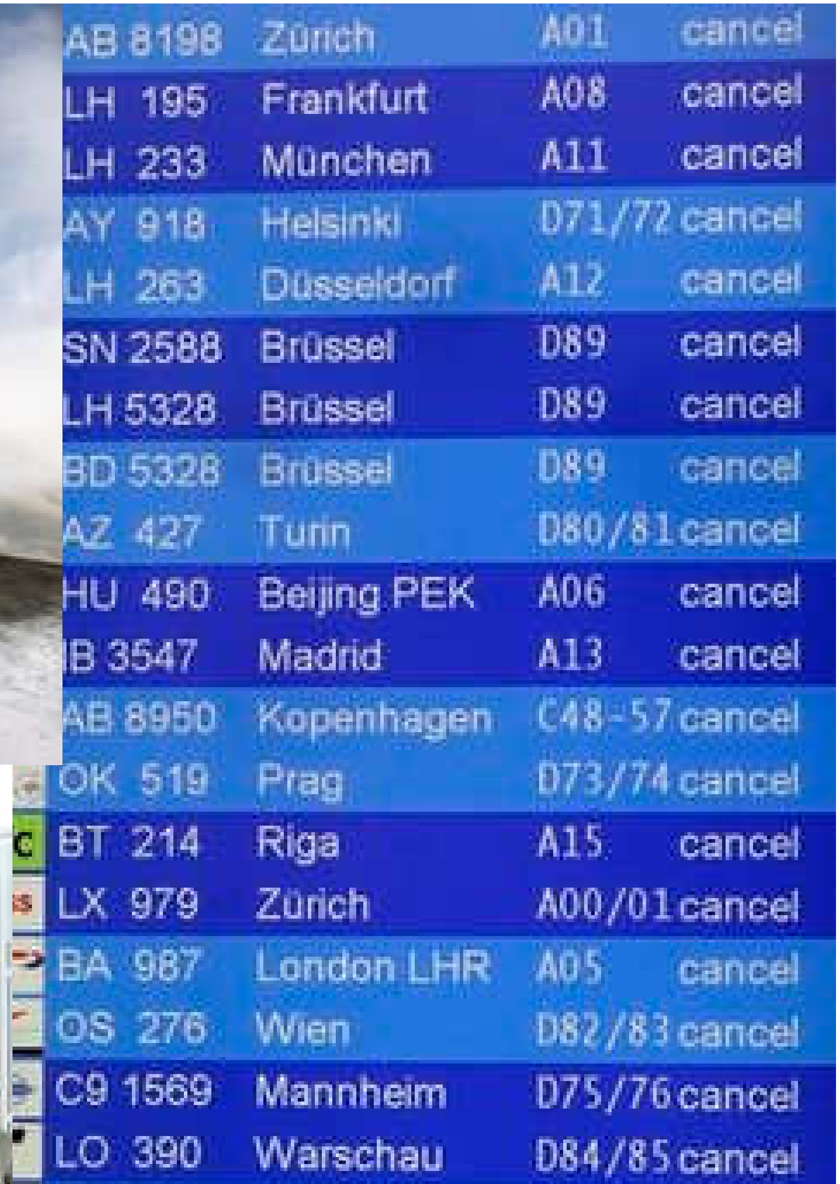
John Grotzinger (Caltech) and David Beaty (Mars Program Office, JPL)

Oct. 1, 2010


First International Conference on
MARS SEDIMENTOLOGY AND STRATIGRAPHY
Conference: April 19–21, 2010
Field Trip: April 21–23, 2010
El Paso, Texas

First International Conference on Mars Sedimentology and Stratigraphy

		MONDAY	***TUESDAY***	***WEDNESDAY***	***THURSDAY***	***FRIDAY***
Session		Planetary context	Physical Stratigraphy	Habitability et al.		
Chairs		Sumner, Gupta	McLennan, Allwood	Grant, Mangold		
Morning	8:00:00 AM	**INTRODUCTION**	**Ori**	**Sumner**	Permian Basin Field Trip	Permian Basin Field Trip (arrives at airport at 3 PM)
	8:15:00 AM	**John G.**				
	8:30:00 AM		Wilkinson	Allwood		
	8:45:00 AM	Milliken	Metz	Nicoll		
	9:00:00 AM	Andrews-Hanna	Ehlmann	**Summons**		
	9:15:00 AM	Dohm				
	9:30:00 AM		**Discussion + margin**	**Session Discussion**		
	9:45:00 AM	*Coffee Break*	*Coffee Break*			
	10:00:00 AM	Howard	**Kocurek**	*Coffee Break*		
	10:15:00 AM	Oehler		**CONFERENCE DISCUSSION**		
	10:30:00 AM		Vasavada			
	10:45:00 AM	**McLennan**	Edgar			
	11:00:00 AM		Bishop	**Field Trip Introduction**		
	11:15:00 AM	**SESSION DISCUSSION**				
	11:30:00 AM		**Session Discussion**			
	11:45:00 AM			**saddle up 11:45**		
LUNCH				Permian Basin Field Trip (departs at noon)		
Chairs		Dromart, Milliken	Kocurek, Ori			
Session		Mineralogy and Strat.	Crater infill stratigraphy			
Afternoon	1:15:00 PM	**Mangold**	**Gupta**			
	1:30:00 PM					
	1:45:00 PM	Le Diet	Irwin			
	2:00:00 PM	Flahaut	Anderson			
	2:15:00 PM	Wiseman	Switzer			
	2:30:00 AM					
	2:45:00 PM	**Discussion + margin**	**Discussion + margin**			
	3:00:00 AM	*Coffee Break*	*Coffee Break*			
	3:15:00 PM	Loizaux	Chan			
	3:30:00 PM	Vaniman	Rice			
	3:45:00 PM	Bristow	Grant			
	4:00:00 PM					
	4:15:00 PM	**Directed DISCUSSION (led by Tanaka): Geologic time scale**	**SESSION DISCUSSION**			
	4:30:00 PM					
	4:45:00 PM					
	5:00:00 PM					
		POSTER SESSION	**OPEN**			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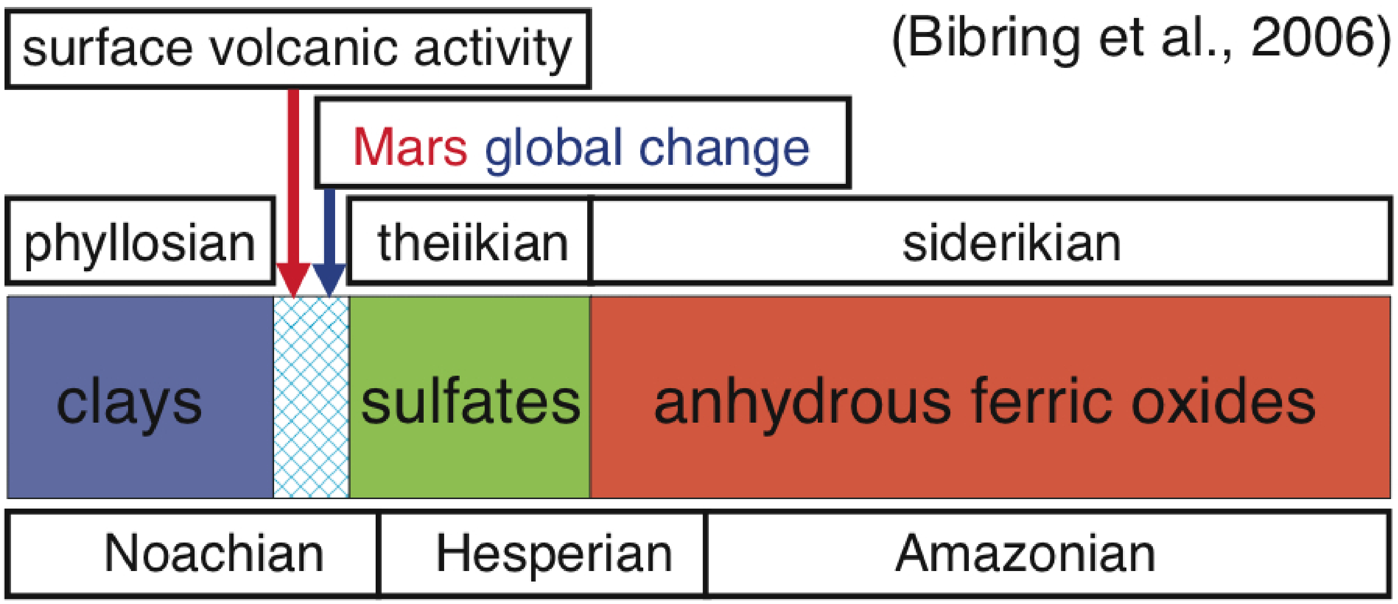
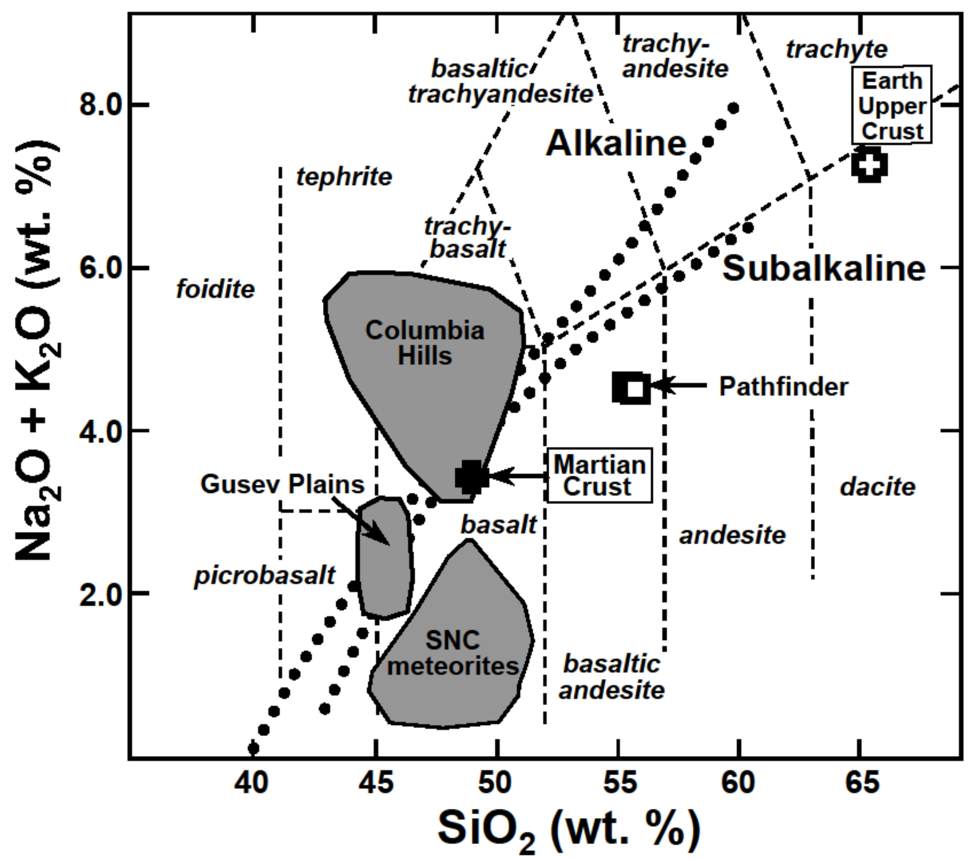
Q1: What were/are the mechanisms for sediment production on Mars and did these processes or rates vary through geologic time?



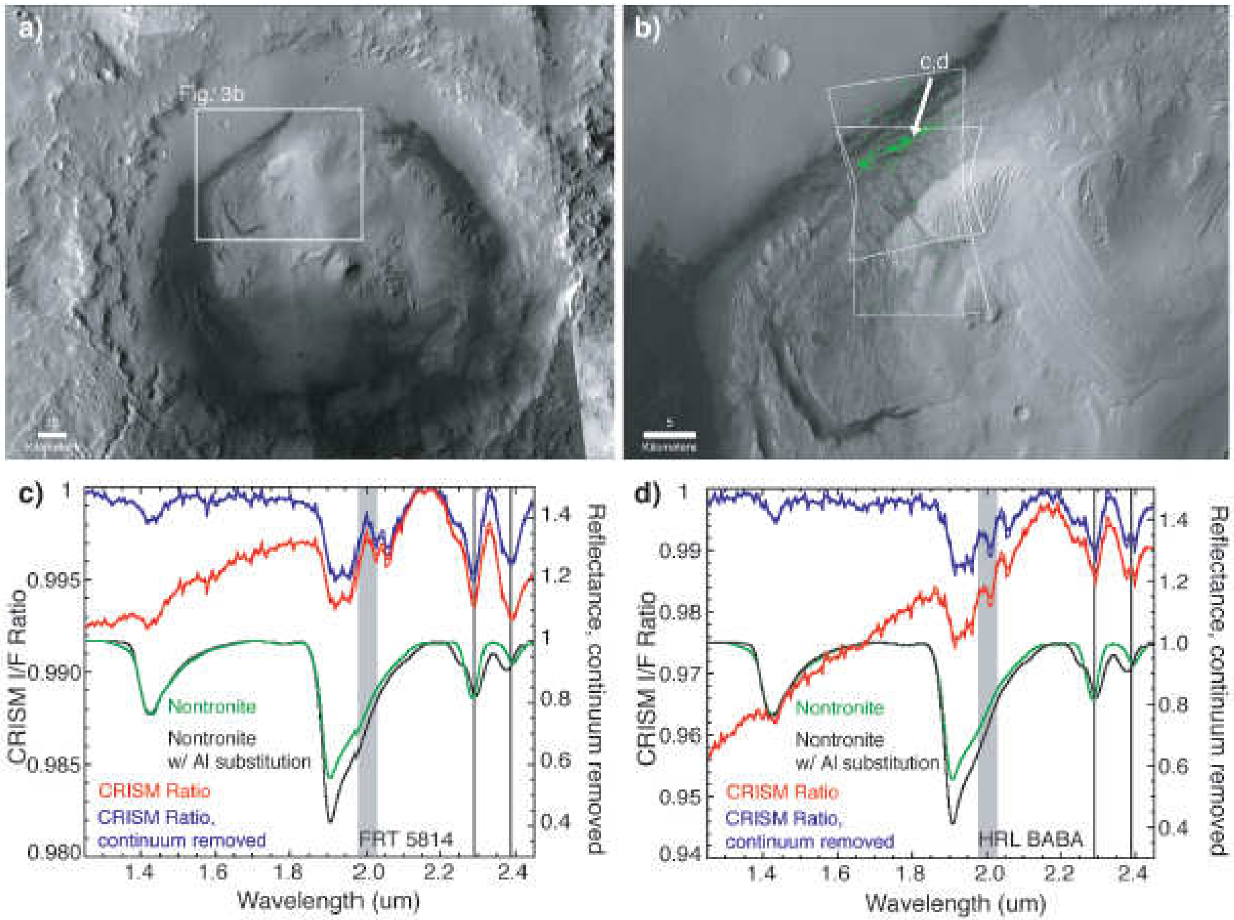
One current scenario for the environmental evolution of Mars surface environments through time (after Bibring et al., 2006). The timing of sedimentary rock formation and mineralogy supports this model (Milliken et al., 2010).

Q2: What is the composition, both mineralogical and chemical, of modern and ancient martian sediments? What were the global geochemical cycles for S and C, and what role did the sedimentary record play in this cycle?



The martian crust is basaltic in character and has a chemical and mineralogical character that fundamentally differs from the "granodioritic" terrestrial upper crust. This difference in turn will have profound implications for the chemical and mineralogical composition of Martian sedimentary rocks and how processes, such as weathering, sorting and diagenesis, will influence these compositions.

Q3: How can we use the stratigraphic record on Mars to extract information on its planetary evolution?

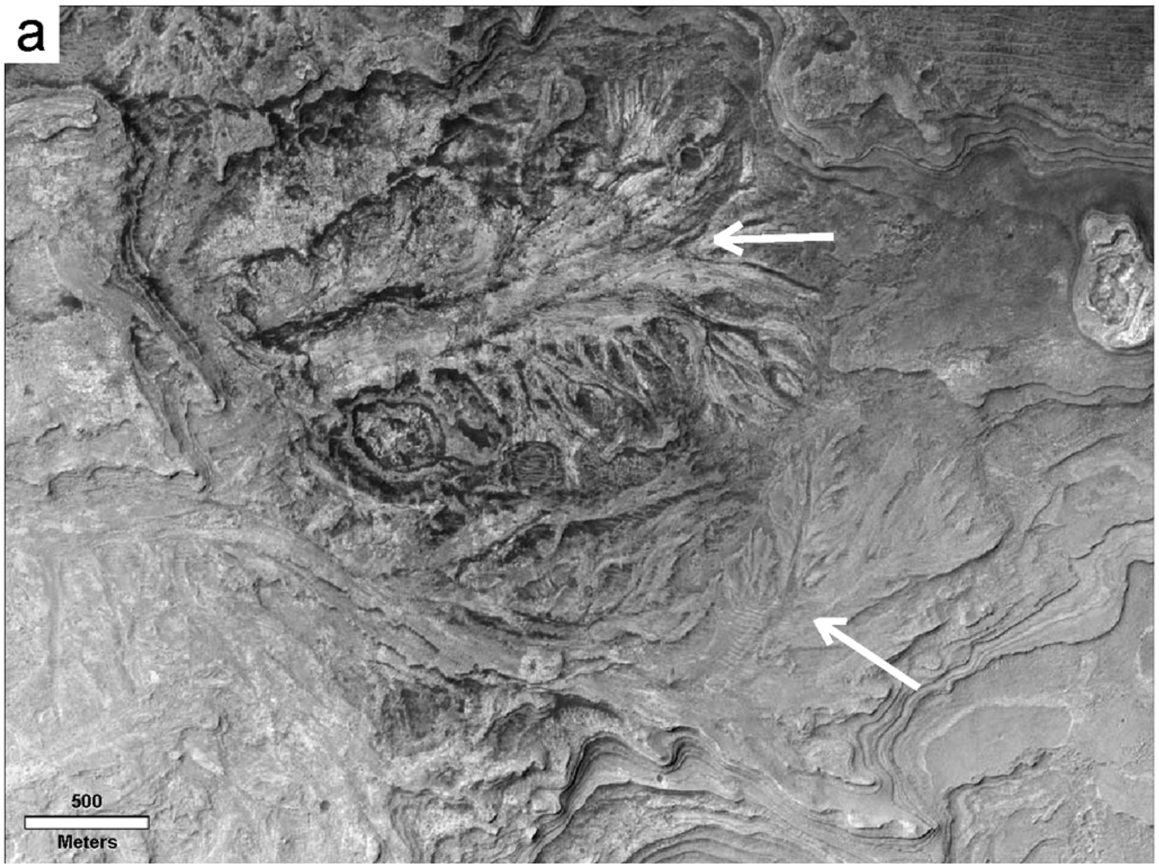


CRISM detection of Fe-smectite in separate observations of strata in Gale Crater. This section may capture a major change in the Martian environment; it preserves evidence for a transition from clay- and sulfate-dominated strata at the base that grades upwards into sulfate-dominated (clay-free) strata.

These observations suggest S-volatiles were predominant throughout the period of deposition.

From Milliken et al., 2009.

Q4: How did Source-to-Sink sediment transport systems evolve on Mars?

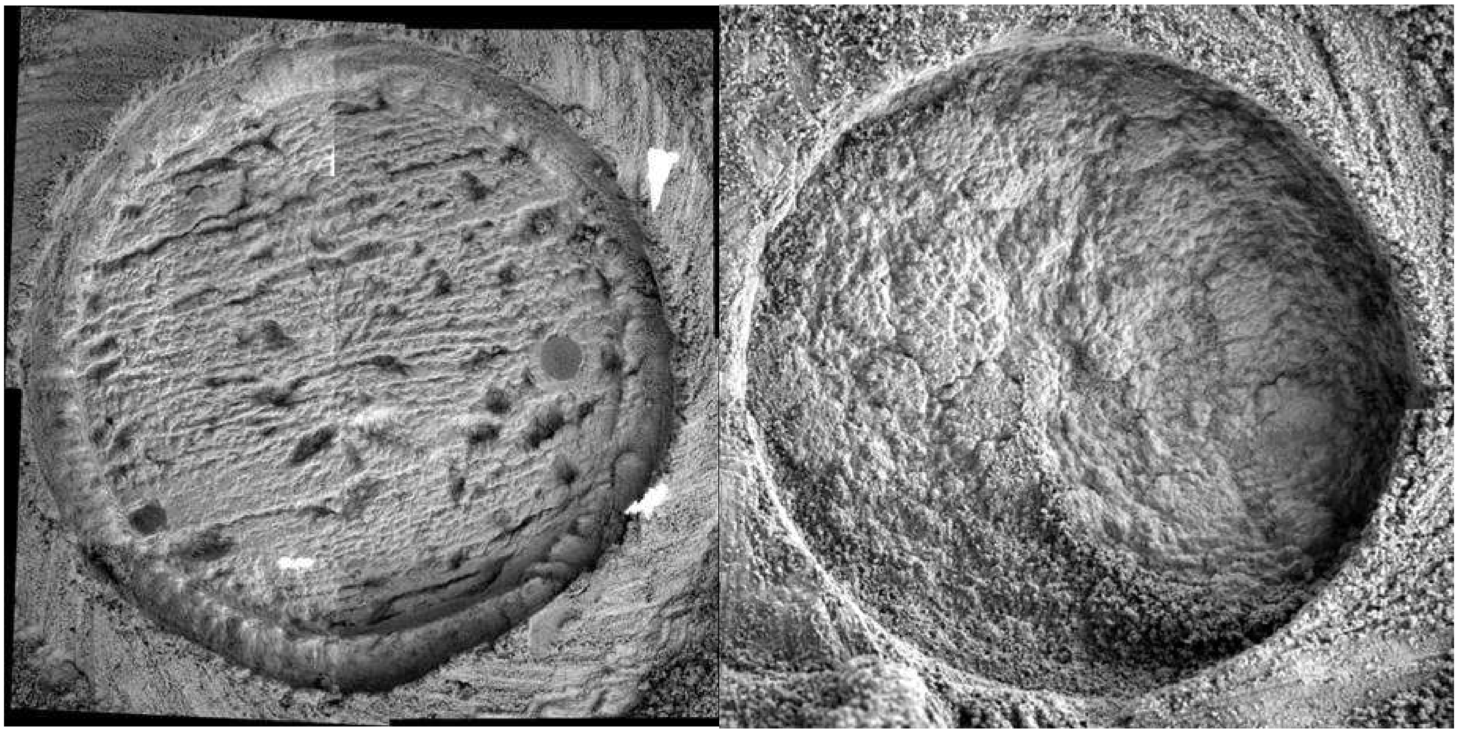


Sub-lacustrine fan systems in Southern Melas Basin, Valles Marineris (Metz et al., 2009).

Q5: What were the mechanisms of sediment accumulation and sediment preservation?

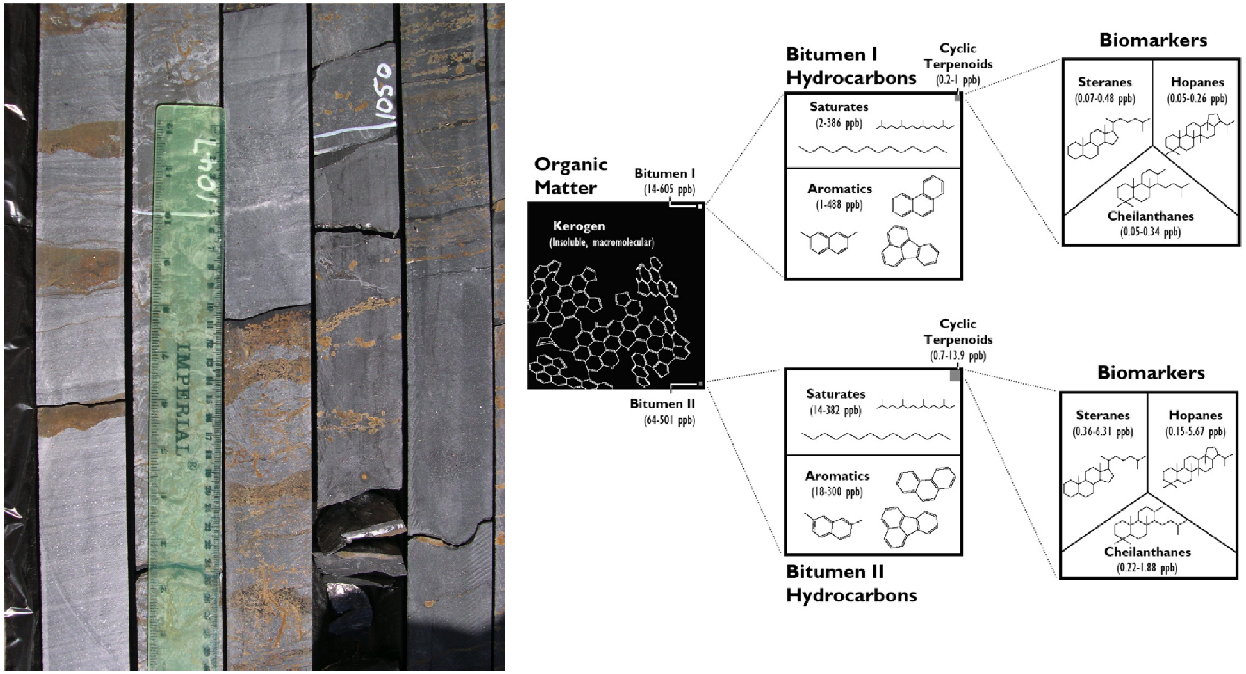
Perspective view of Lower Gale Mound deposits (Milliken et al., 2010). The beds vary vertically in thickness, albedo and texture. The lithology of beds correlates with the stacking pattern of the beds. Units with clay minerals tend to be thin-bedded whereas sulfate-rich units show thicker, possibly amalgamated, bedding.

Q6: In what ways did martian sedimentary rocks become modified after their deposition?



Diagenetic recrystallization of sulfate-rich sediments on Mars. Left; well-stratified sulfate-rich sandstone showing crystal molds after unknown (possibly sulfate) mineral, and hematitic concretions. Right; recrystallization results in homogenization and more coarsely crystalline texture. See McLennan et al., 2005.

Q7: Could the sedimentary record of Mars provide evidence for a former biosphere?



A) Organic molecules sequestered in minerals such as on clay surfaces encased in calcite, as shown here in a 2.6 Ga core from South Africa, are protected from oxidation due to low permeability of the host rocks. B) These organics contain hydrocarbons with very specific distributions of molecular structures that indicate a biological origin as well as provide insights into the ecology of the ancient microbial communities (Waldbauer et al. 2009).

Strategies to Answer the Key Questions

- Additional mapping from orbit
- Increasing our set of landed observations on Mars is critical. Outcrop scale and finer studies are required, especially to understand the relationship between martian sedimentary rocks and astrobiology.
- Many of the above questions would either greatly benefit from, or be essentially dependent on, the return of samples that could be subjected to a variety of modern analytical techniques.
- Establishment of “type” or “reference” sections.

See you at the 2nd International Mars Sed-Strat Conference!

2010 Mars Sed/Strat Field Trip, Sitting Bull Falls, Guadalupe Mountains, TX/NM

Post-Meeting Activity

- Writing group of 11 identified at meeting.
- Production of a report on key concepts and outstanding questions identified in the conference output—to be published in Astrobiology, and also in shorter form in Sedimentary Record.
- Special issue (in progress)